

GRACE Science Data System Level-1 Processing Status

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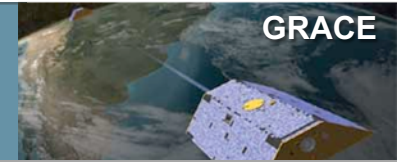
October 9, 2018
Potsdam, Germany

* Jet Propulsion Laboratory, California Institute of Technology

** Center for Space Research, University of Texas at Austin



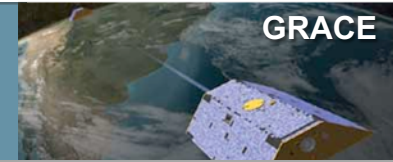
Overview



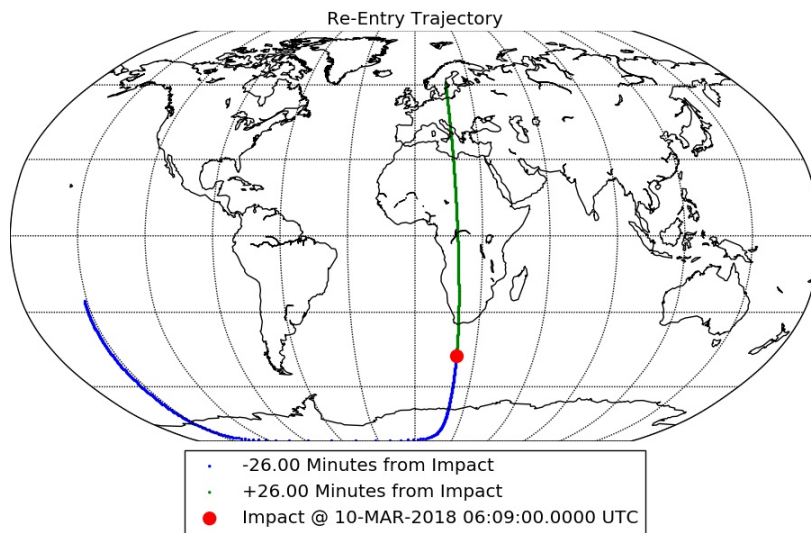
- Current Level-1 data sets availability
- Final Level-1 (V04) data set
- Accelerometer data transplant
- Summary



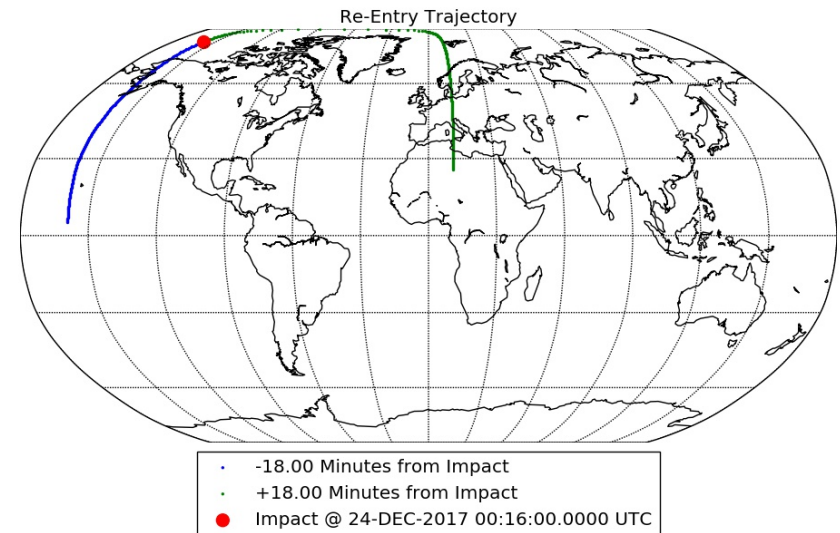
GRACE-A&B Re-entry



GRACE-A
10-MAR-2018



GRACE-B
24-DEC-2017



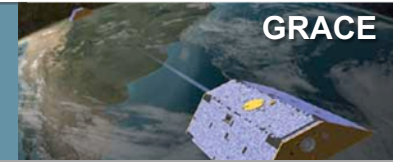
Last usable science telemetry: 01-DEC-2017

Last usable science telemetry: 04-SEP-2017

Source: www.space-track.org



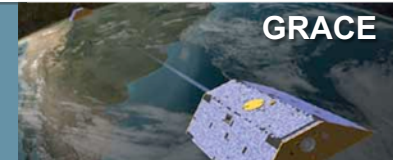
Current Available Level-1 Data Sets



- V02
 - GRACE-A 2002-04-04 to 2017-06-29
 - GRACE-B 2002-04-04 to 2017-06-29
- V03 (SCA1B and KBR1B reprocessing only)
 - GRACE-A 2002-04-04 to 2017-06-29
 - GRACE-B 2002-04-04 to 2017-06-29
- VR3 (ACC1B transplant)
 - GRACE-B 2016-10-11 to 2017-06-29



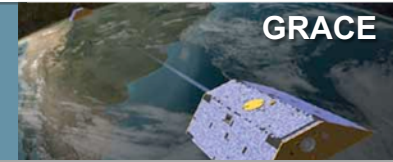
V04 Level-1 Data Reprocessing Plan



- Objectives:
 - Correct known problems in previous versions, which had a minimal impact on science data products
 - + ACC time tag correction
 - + Stellar aberration for star tracker data (corrected in V03)
 - Implement improved/updated data processing algorithms
 - + Precision Orbit Determination
 - + Precision Attitude Determination using SCA and ACC data
 - + KBR “Missed Interrupt” time tag corrections
 - Use latest alignment products
 - + VKB (KBR boresight vector)
 - + QSA (Star tracker alignment quaternions)
 - Synthesize ACC1B data (transplant) when the ACC for one spacecraft is not operational while all other science measurements are available
- V04 will be generated with GRACE-FO Level-1 processing software
 - Guarantee consistency between GRACE and GRACE-FO



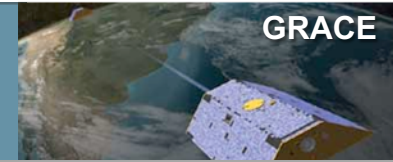
V04 Level-1 Data Set



- V04 data set time span (includes spans when no science is possible)
 - GRACE-A 2002-03-17 to 2017-12-01
 - GRACE-B 2002-03-17 to 2017-09-04
- V04 data set will contain all telemetry available that can be processed
- V04 data set will contain synthesized accelerometer data (transplant) provided in a new product (ACT1B) using the ACC1B format
 - GRACE-A ACT1B May and June 2002
 - GRACE-B ACT1B after September 2016
- V04 data will be distributed as ASCII files with new yaml headers
 - Distribution identical to GRACE-FO
 - Compliance with new NASA archiving standards
 - Level-1A and Level-1B data will be distributed



V04 Level-1 Processing Schedule

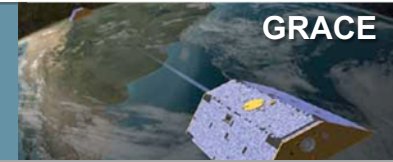


- V04 data processing will start 2018-11-01*
- Completion of initial V04 data processing 2019-05-01*
- Completion Quality Assurance 2019-11-01*
- Distribution with RL07 gravity fields

*V04 processing schedule is contingent on GRACE-FO Level-1 processing activities (GRACE-FO team will reprocess GRACE)



Accelerometer Data Transplant



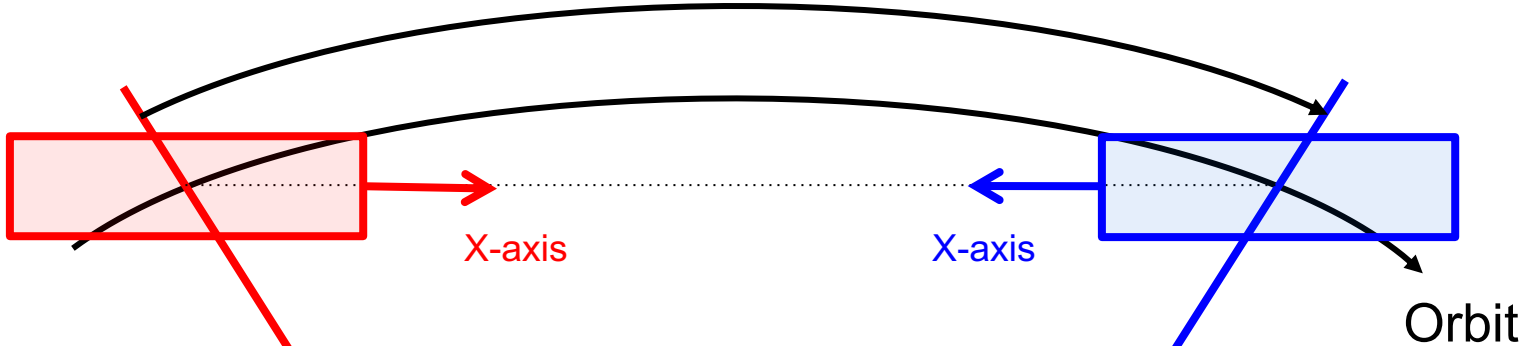
- ACC transplant assumptions for non-conservative forces that act on the GRACE spacecraft:
 - Atmospheric drag (very similar for both S/C. Differences due to different angle of attack with respect to the atmosphere)
 - Solar radiation pressure (very similar for both S/C. Difference due to slightly different S/C attitudes)
 - Attitude thruster pair imbalance (different on both S/C. Attitude control on-time commanding different)
- Objective of ACC data transplant is to synthesize ACC data for a given GRACE satellite based on ACC measurements of the other GRACE spacecraft.
- Full description of transplant procedure in Bandikova et al. (2018):
“GRACE Accelerometer Data Transplant” (submitted to Advances in Space Research)



GRACE-A to GRACE-B Accelerometer Transplant Nominal Science Spacecraft Attitude



Spacecraft separation (~170 to ~270 km)

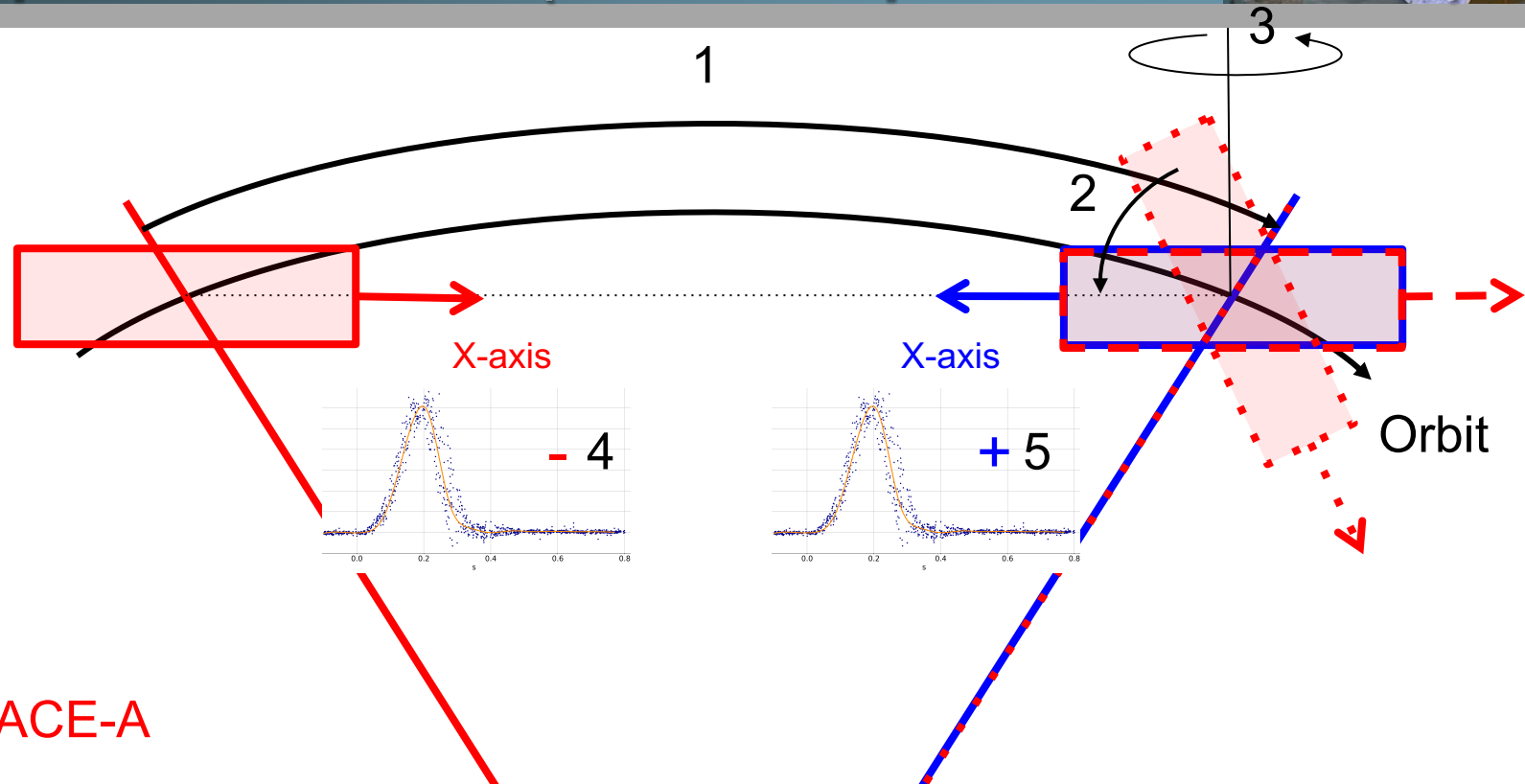


GRACE-A

GRACE-B



GRACE-A to GRACE-B Accelerometer Transplant Procedure (Nominal Spacecraft Attitude)



GRACE-A

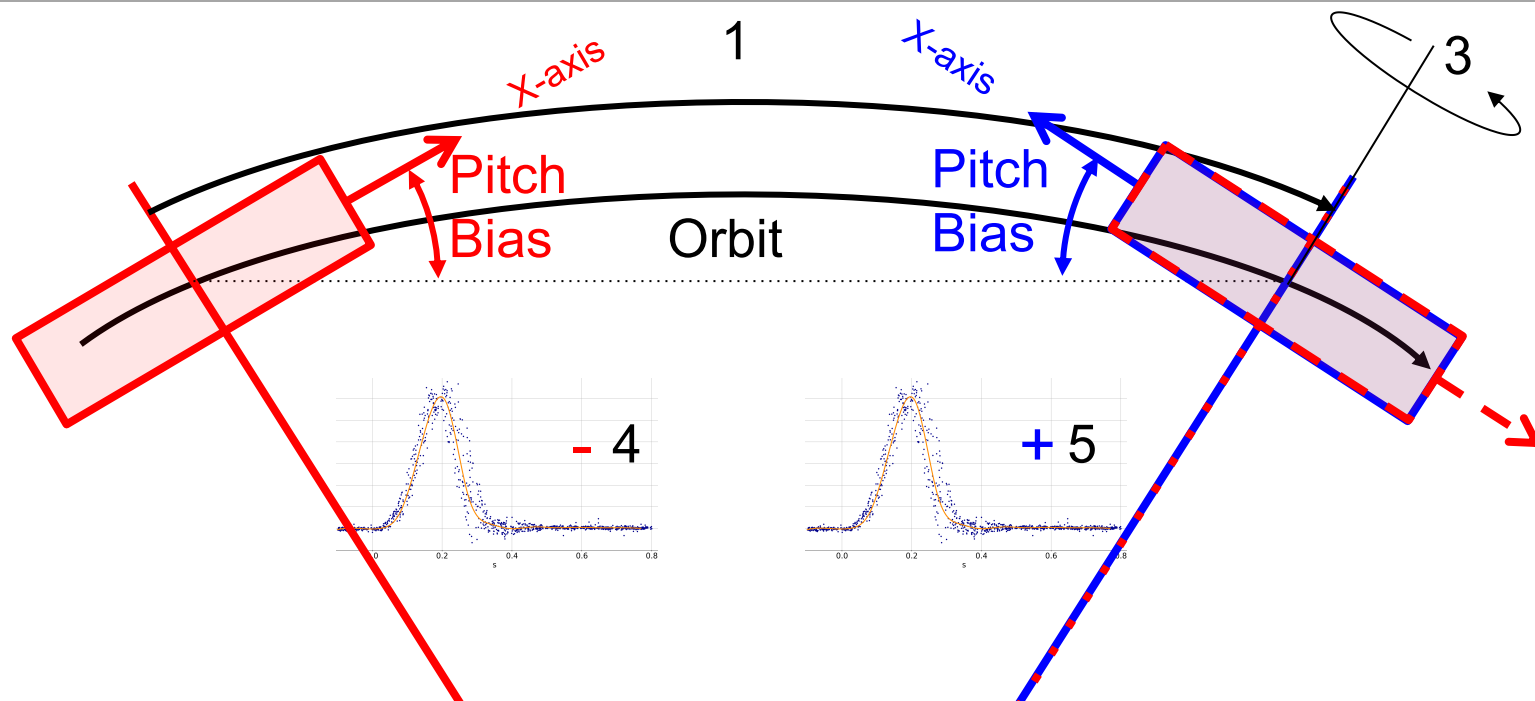
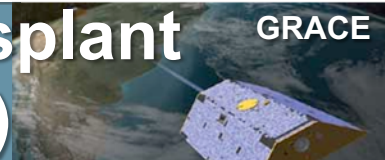
GRACE-B

- 1) Time shift derived from spacecraft separation
- 2) Correct spacecraft orientation for pitch rate
- 3) Reverse spacecraft orientation
- 4) Remove GRACE-A ACC thrust response
- 5) Add GRACE-B ACC thrust response



GRACE-A to GRACE-B Accelerometer Transplant Transplant Procedure (With Pitch Bias)

GRACE



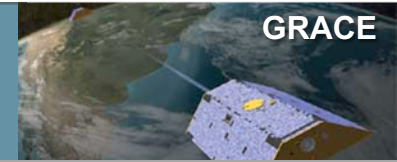
GRACE-A

GRACE-B

- 1) Time shift derived from spacecraft separation
- 2) No pitch rate attitude correction
- 3) Reverse spacecraft orientation
- 4) Remove GRACE-A ACC thrust response
- 5) Add GRACE-B ACC thrust response



Summary



- Current V02/V03 available Level-1 data sets cover time span for which science is possible (2002-04-04 to 2017-06-29)
- V04 Level-1 data:
 - Reprocess all days for which usable telemetry is available
 - Reprocess with updated algorithms for POD and S/C attitude reconstruction
 - Reprocess with updated alignments for KBR phase center and star tracker alignments
 - Generate ACC transplant data
 - Completion of reprocessing and quality assurance expected in Nov 2019
 - Distribution with RL07 gravity products release

